tion that natural forms, *geometrically* arranged, should be resorted to for ornamentation. Mr. Whitaker takes the same view, using, indeed, almost our words. Speaking of such an application of flowers in their natural form as is sometimes seen, without any connection with architectural features, he says,—"There has hitherto been a conventional blindness to the absurdity of their adoption in this way, which is a mode totally different from the one I am propounding, which proposes in the first instance to give by means of a geometrical representation an architectural character, and then to connect them with architectural designs on the most approved principle revealed in antique and mediæval art."

The book contains fifty plates, nicely lithographed, and will be found of important service, not merely to architects and decorators, but to muslin and calico designers, bookbinders, plasterers' modellers, paper-stainers, and all connected with ornamental design. We are firmly of opinion that Mr. Whitaker has done service by the production and publication of this book, and we hope it will find the good sale it deserves.

"Life is short and Art is long." Those who smooth the way deserve well of their fellows.

ON THE VARIOUS QUALITIES OF CAEN STONE.

In all well-regulated concerns of an extensive kind, a judicious division of labour is indispensable; an architect would require his life and faculties to be prolonged to the extent of the patriarchs of old were he to attempt, by his own personal observations, to gain a thorough knowledge of the numerous materials employed in an extensive edifice. The practical part of his profession alone, if scientifically studied, is far too extensive for the brevity of one man's life; it must be the result of accumulated knowledge, the collective labour of many observant individuals; such a mass of information can, therefore, only be acquired collaterally, through the medium of books, and oral communications.

It is a duty incumbent on every member of society to use his best endeavours, however insignificant, to facilitate the advancement of knowledge, and to make his fellow creatures as much wiser and as much better informed as lies in his power. Under these impressions, I venture to shew my zeal in the cause, by offering some observations on the nature and properties of stone from the quarries at Caen and its neighbourhood.

The stone in most general use for ornamental architecture, in the south of England, is obtained chiefly from that extensive tract of country usually denominated the "Oolitic district," which passes from Yorkshire through the various counties until it reaches the coast of Dorsetshire. The same kind of stone again appears in Normandy, and its characteristic features prevail in the celebrated quarries around the city of Caen: diverging into several branches or ranges of hills, it traverses France, forms the great mass of the Jura Mountains, and constitutes part of the chain of the Alps. The Oolitic rocks of Normandy present a close analogy in their general, and even in some of their minor divisions, to those of southern England: commencing in the vicinity of Havre de Grace, and extending our observations to the neighbourhood of Caen and Falaise, we find a series of beds corresponding with those of the Oolite in our own country. It would thus appear, that throughout a considerable portion of France and England, the causes which produced the Oolitic rocks did not differ materially; shewing, that at the time of their production, similar general causes were in action over a particular portion of the two countries, probably long before the sinking of the land which produced the English Channel.

The entire country from the sea to some distance beyond Falaise, and from Bayeux to a considerable distance east of Caen, is composed of the same mineralogical description of strata; remarkably horizontal, and in all probability continuous, or without interruptions. The comparative insignificance of elevations or depressions, merely of a few yards, up or down, is unimportant when considered on the principle of a general level. It rarely happens that a district, of 30 or 40 miles in area, presents so tame and unpicturesque a scene, so apparently undisturbed by any geological phenomena, as is to be found in the neighbourhood of Caen. All these various beds of Oolitic limestone are of marine origin—consequently they must have been deposited at the bottom of an ancient sea, and then upheaved to their present position, where they appear to have remained undisturbed since the period of their consolidation, affording a striking example of long continued tranquillity; and remarkably contrasting with the violent distortions, depressions, fractures, and denudations, so conspicuous on the opposite coast, from the Isle of Wight to the extremity of Dorsetshire. The only instance of a geological disturbance in the district appeared to me to be in the line of the river Orne, and the variation of level about the entrances to the principal quarries, which seems to have been caused by a *fault*, either of elevation or subsidence; and I am inclined to believe that the very same strata, which have been so long worked for architectural purposes, might be found beneath the meadows, on the low side of the river. Such a disruption of rocky masses is at first startling to the imagination of a common observer, but extremely insignificant to the geologist. Whether such change took place by upheaving or sinking, it must have been uniform over a considerable area, for there is hardly an instance in which the strata are bent or contorted from the level.

On approaching the coast of Normandy, from the English Channel, and for some distance up the river Orne, on the eastern bank, rocky masses of a hard calcareous nature are abundantly sprinkled near the coast, and scarcely to be seen above water, which renders the navigation so far dangerous, that vessels are compelled to take a pilot to enter the Orne. This same stratum of limestone, being very nearly level, continues also inland to the eastward, where there are quarries at Cagny and at Bonneville; but the most extensive quarries of this material are situated at Ranville, close to the eastern bank of the Orne, about halfway between the sea and the city of Caen. This stone is composed almost entirely of broken shells, occasionally rather oolitic, and containing fragments of very small fossil corals: the whole slightly and irregularly laminated, is united into a mass with a strong calcareous and highly crystalline cement. In geological position this limestone rests upon the Caen freestone. It resembles in general structure and composition several varieties of similar material to be found in our own country, such as the Hamhill stone near Yeovil, the Taynton near Burford, that of Weldon-in-the Wood, Northamptonshire, and a few more, all of which are well known to be extremely durable, although they are usually rather too coarse grained to be used for minute ornaments, but no doubt admirably adapted for bold architectural or engineering works.*

Before particularising the stone of any precise spot, it may be well to state that the city of Caen, together with its entire environs, rest immediately upon the rocks of freestone. The bare strata may be observed on the surface of the ground, all round the foundations of some of the principal buildings of the city and villages in the neighbourhood. Although the beds in general appear to be perfectly level, nevertheless, upon a more attentive examination, through a distance of 10 or 12 miles, an evident depression may be observed from inland towards the sea, of probably about 100 feet, or an angle of something like 1 in height to 500 in length; for this reason the beds of Caen freestone are not to be found on the coast, where, if they are continuous, they are buried beneath the Ranville rocks, and probably form the bed of the sea.

From the general flatness of the country it is rather difficult to distinguish the precise localities where older rocks have risen from beneath to the surface through the freestone beds; and in the immediate neighbourhood of Caen such features appear to be of rare occurrence. It is pretty certain that the same calcareous strata may be traced in continuity round the city as far as St. Croix and Tourville on the west; also to Fontenay; and on the road from Caen to Falaise, with one or two slight interruptions, similar stone may be found throughout nearly the whole distance of 20 miles, for I am disposed to consider the quarries of St. Pierre and Aubigny merely as modifications of the same rock.

Leaving the consideration of subjects which may appear remote and hypothetical, I now proceed to the main object of inquiry, which is to describe the different qualities of Caen stone. As I have already stated, there are many places in the neighbourhood from whence building stone is at this time procured; and there are others where the name and inequality of surface would lead us to suppose that, in by-gone times, quarrying operations had been practised to a considerable extent, although long since discontinued. Even close to the walls of the citadel, and midway between two of the largest buildings in the city, namely, the churches of St. Stephen and the Holy Trinity, there are places still retaining the names of the "Old Quarries," the "New Quarries," and the "Little Quarries:" of these I shall have occasion to offer some remarks hereafter. But the principal quarries from whence Caen stone is procured, which, from their number and extent, we may infer have been in work during several centuries, are situated from 1½ mile to 2 miles' distance, on the south-west of the city, near to the village of Haute Allemagne. The surface of the country, especially that part over the quarries, is nearly level, having a very slight inclination towards the north-east, so as to drain into the river which divides the high from the low land. The river above the city is very narrow and shallow, little more than a brook or rivulet, and has never been used for the conveyance of stone, although it runs close by the entrances to the principal quarries. The quarries, to the number of about 30 or 40, are all subterranean, and are entered from a road along the side of the hill, or escarpment. A few shafts have been sunk from the surface perpendicularly, up which the blocks of stone are hoisted. The shaft quarries are situated at a considerable distance from those which are entered from the side of the hill, and have therefore no communication from one to the other. In one or two cases, these shaft quarries have been deserted, on account of the water finding its way from the surface into them.

The surface soil in the vicinity of Caen, as is usual in stone countries, is made up of little stones, partly disintegrated rock, and a small quantity of mould, or decomposed vegetable matter. Beneath this, from 20 to 50 feet deep, according to situation, as it may be near to, or distant from, the river, are numerous strata of hard coarse rubbly limestone, of various thicknesses, from a few inches to 3 or 4 feet, with, occasionally, layers of small cherty nodules between the beds, a few inches thick. This entire mass of useless matter forms what is termed the head of the quarry. The actual number of beds is uncertain, for only six have been selected as marketable, or most fit for architectural purposes: beneath these, the stone is not extracted. These six beds, which rest upon each other without interposition, vary in thickness from about 2 feet to 5 feet or more. The estimated aggregate thickness of them all, may be taken at about 17 feet, although in some places the total depth may probably amount to 22 feet. The natural vertical joints being square to each other, and wide apart, blocks of large and varied size can be obtained, even to the extent of 15 feet in length, by 5 feet or more square, but such dimensions are never extracted or required, on account of the many practical difficulties in removal and transport. The names, dimensions, and certain distinctive characters of these workable beds, have been so ably described by Mr. Donaldson and have so recently appeared in THE BUILDER, from the pen of Mr. Godwin, that I need not attempt a repetition.*

Such then is a general outline of the geology of the Caen stone district. The next part of

* I am informed that Ranville stone is being supplied for some part of the sea-wall of the Harbour at Dover.

* See Vol. VI., p. 491 and p. 493.

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